to provide in return the tactics used in securing funding from the administration for his new equipment!

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The CT scanner at St. Catharines General Hospital, St. Catharines, Ont., has been the only scanner in the Niagara peninsula until recently. It has been operating for two shifts a day, and the waiting time for nonurgent cases is 4 to 5 months.

Last year we conducted 8652 scans. The figure could reach 9000 toward the end of this year. With the commissioning of the scanner at Welland County General Hospital the workload is likely to decrease.

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[Dr. Lyons responds:]

We are currently performing more than 17 000 CT examinations yearly on two scanners. One scanner operates for almost 60 hours per week and does more than 10 000 examinations a year; the other scanner operates for almost 56 hours per week and does about 7000 examinations a year. Corporate representatives informed us that the former was, in fact, the busiest of all the CT scanners they had sold. This is hardly a scientific assessment of workloads around the world and was not meant to be.

Scanners that operate at that level are efficient; however, presumably their life span is shortened. We are looking at reducing the hours of operation as a result of ever-increasing efficiencies within the section and would be pleased to discuss any suggestions from St. Joseph's Hospital that might further improve our operation.

I would gladly relinquish the claim of having the "busiest scanners in [the] world" for the ability to offer timely studies to patients who have a legitimate need.

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Vitamin D and aluminum absorption

The continuing reports of an association between aluminum and Alzheimer's disease (for example, "Would decreased aluminum ingestion reduce the incidence of Alzheimer's disease?," by Dr. Donald R. Crapper McLachlan and colleagues [*Can Med Assoc J* 1991; 145: 793–804]) together with the observed geographic association between Alzheimer's disease and aluminum levels in drinking water[1] suggest that the prophylactic reduction of aluminum absorption may be worth while.[2] This will be more feasible once the factors that determine the bioavailability of aluminum are better known.[3]

Substances known to *decrease* aluminum absorption or retention include phosphate,[4] iron[5] and fluoride.[4,6] Phosphate decreases aluminum absorption through the formation of insoluble dialuminum triphosphate.[4] Adequate body stores of iron help prevent the intestinal absorption of aluminum, presumably because aluminum competes with iron for binding sites on transferrin.[4,7] The latter is thought to explain the anemia observed in aluminum poisoning. Fluoride increases the elimination of aluminum in urine and feces, possibly because of the formation of aluminum hexafluoride, a readily soluble complex that prevents binding to transferrin.[4,5]

Substances known to *increase* aluminum absorption include maltol (an important contributor to the natural flavour of cooked foods),[8] citric acid[4,5,7] and parathyroid hormone or dietary vitamin D;[9–16] a diet deficient in calcium,[4,5] iron[4,5] or zinc[17] will also increase absorption. The interactions between calcium nutritional status and aluminum absorption are likely mediated by the vitamin-D endocrine system. Dietary supplementation with vitamin D increases the aluminum content in the muscles and hearts of rats fed an aluminum-supplemented diet.[9] Parathyroid hormone increases the intestinal absorption of aluminum, in part by stimulating the renal synthesis of 1,25-dihydroxyvitamin D_3. In one study 1,25-dihydroxyvitamin D_3 decreased aluminum levels in the liver while increasing those in plasma.[12] Aluminum is absorbed in the duodenum by a nonsaturable mechanism and by a vitamin-D-dependent saturable mechanism for which it competes with calcium.[13] Thus, saturable aluminum absorption was significantly lower in vitamin-D-deficient rats than in vitamin-D-replete animals.[13] Conversely, the addition of aluminum to a perfusion medium decreased calcium absorption by 33% in isolated gut segments from vitamin-D-deficient rats.[13] As evidence of the effects of vitamin D, substantial aluminum absorption causes osteomalacia, which is not reversed by treatment with vitamin D.[15,16]

With respect to the brain, axonal swellings of Purkinje cells occur in chickens fed elevated amounts of aluminum and 1,25-dihydroxyvitamin D_3.[18] Evidence that the brain is a target for vitamin D[19] helps explain the association between calcium homeostasis and the accumulation of aluminum in the brain with age. The most active form of vitamin

D is 1,25-dihydroxyvitamin D_3; vitamin D is about half as active in stimulating calcium uptake in chick intestine maintained in organ culture[20] and likely has a parallel effect on aluminum absorption.

Regardless of whether dietary vitamin D acts directly or indirectly through 1,25-dihydroxyvitamin D_3 it does increase tissue levels of aluminum in various animals[9-14,18] and in humans.[15,16] Virtually all the vitamin D that humans consume is from food additives; this makes it more feasible to control vitamin D ingestion than to control aluminum intake. If further evidence confirms an association between vitamin D and the accumulation of aluminum in the brain it may be important to control the ingestion of vitamin D as well as that of aluminum.

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References

1. Martyn CN, Barker DJPP, Osmond C et al: Geographical relation between Alzheimer's disease and aluminum in drinking water. *Lancet* 1989; 1: 59-62
2. Lione A: The prophylactic reduction of aluminum intake. *Food Chem Toxicol* 1983; 21: 103-109
3. Fleming LW, Prescott A, Stewart WK et al: Bioavailability of aluminum [C]. *Lancet* 1989; 1: 433
4. Martin RB: The chemistry of aluminum as related to biology and medicine. *Clin Chem* 1986; 32: 1797-1806
5. Ihle BU, Becker GJ: Gastrointestinal absorption of aluminum. *Am J Kidney Dis* 1985; 6: 302-305
6. Wills MR, Savory J: Aluminum poisoning: dialysis encephalopathy, osteomalacia, and anemia. *Lancet* 1983; 2: 29-33
7. Slanina P, Frech W, Eckström LG et al: Dietary citric acid enhances absorption of aluminum in antacids. *Clin Chem* 1986; 32: 539-541
8. Farrar G, Blair JA: Aluminum and Alzheimer's disease [C]. *Lancet* 1989; 1: 269
9. Anthony J, Fadl S, Mason C et al: Absorption, deposition and distribution of dietary aluminum in immature rats: effects of dietary vitamin D_3 and food-borne chelating agent. *J Environ Sci Health [B]* 1986; 21: 191-205
10. Mayor GH, Keiser JA, Makdani D et al: Aluminum absorption and distribution: effect of parathyroid hormone. *Science* 1977; 197: 1187-1189
11. Mayor GH, Burnatowska-Hledin MA: Impaired renal function and aluminum metabolism. *Fed Proc* 1983; 42: 2979-2983
12. Drüeke T, Lacour B, Touam M et al: Oral aluminum administration to uremic, hyperparathyroid, or vitamin D-supplemented rats. *Nephron* 1985; 39: 10-17
13. Adler AJ, Berlyne GM: Duodenal aluminum absorption in the rat: effect of vitamin D. *Am J Physiol* 1985; 249: G209-G213
14. Chan JCM, Jacob M, Brown S et al: Aluminum metabolism in rats: effects of vitamin D dihydrotachysterol, 1,25-dihydroxyvitamin D and phosphate binders. *Nephron* 1988; 48: 61-64
15. Boyce BF, Elder HY, Elliot HL et al: Hypercalcemic osteomalacia due to aluminum toxicity. *Lancet* 1982; 2: 1009-1012
16. Colussi G, Rombola G, De Ferrari ME et al: Vitamin D treatment: a hidden risk factor for aluminum bone toxicity? *Nephron* 1987; 47: 78-80
17. Wenk GL, Stemmer KL: Suboptimal dietary zinc intake increases aluminum accumulation into the rat brain. *Brain Res* 1983; 288: 393-395
18. Long JF, Nagode LA, Kendig LA et al: Axonal swelling of Purkinje cells in chickens associated with high intake of $1,25(OH)_2D_3$ and elevated dietary aluminum. *Neurotoxicology* 1980; 1: 111-120
19. Luine VN, Sonnenberg J, Christakos S: Vitamin D: Is the brain a target? *Steroids* 1987; 49: 133-153
20. Corradino RA: Embryonic chick intestine in organ culture: response to vitamin D_3 and its metabolites. *Science* 1973; 179: 402-405

Glandular tularemia with typhoidal features in a Manitoba child

I read with great interest the recent report by Dr. Pierre J. Plourde and associates (*Can Med Assoc J* 1992; 146: 1953-1955) about this fairly rare disease.

The authors' statement that isolated outbreaks have been reported only in Quebec in the last 25 years, however, is erroneous. There have been two cases reported in Newfoundland within the last 15 years: one in 1981, which was confirmed by the Department of Health, and one in 1983, which I reported.[1]

As noted in the discussion of my article it certainly appears that the incidence of tularemia is low in Newfoundland. However, given the broad spectrum of clinical manifestations, there may be subclinical cases, from mild, nonulcerative glandular lesions to more severe forms, as described in the *CMAJ* article.

I also note that Plourde and associates do not mention the use of tetracycline. In the case that I saw, tetracycline settled down the disease process, and the patient recovered. Although tetracycline is effective, relapse may occur.

A high degree of suspicion is needed for this disease, or cases may very well be missed.

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Reference

1. Tularemia — Newfoundland. *Can Dis Wkly Rep* 1984; 10: 138-139

The therapeutic value of cats

Dr. Douglas Waugh's article in the Apr. 1, 1992, issue of *CMAJ* (146: 1233) should bring a chuckle to those who feel a kinship either to cats of all ages or only to lovable kittens.

Although our family has had long acquaintance with both cats and dogs I must admit feeling somewhat intimidated by our feline friends.

Could it be that I am somewhat thin-skinned? (I could blame it on an allergy, which was actually responsible for my only bout of